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(21)Application number : **2000-136170** (71)Applicant : **SONY CORP**

(22)Date of filing : **09.05.2000** (72)Inventor : **IWAHASHI MITSUGI**  
**UENO NAOTO**

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**(54) NON-CONTACT IC CARD AND PRODUCING METHOD THEREFOR**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a non-contact IC card, which is superior in the flatness of the surface and on which extract and clear character or picture can be printed, with a simple configuration at a low cost.

**SOLUTION:** The non-contact IC card 10 has a nine-layer laminated structure and is composed of a center core 6 in a five-layer laminated structure, an adhesive agent layer 2 and a sheathing sheet 1 laminated on both the upper and lower surface of that center core. The center core 6 is manufactured by incorporating an IC chip in a through hole 5a by thermally fusing a first internal sheet 5 with the through hole 5a on both the upper and lower surfaces of a circuit board 3 provided with an IC chip 3a and by closing the upper and lower parts of the through hole 5a by thermally fusing a second internal sheet 4 on this first internal sheet. The adhesive agent layer 2 has a finished flat surface on the side of the sheathing sheet and thereby, the surface of the center core, which has unevenness a little, is smoothened and the surface of the card is made flat.

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## CLAIMS

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[Claim(s)]

[Claim 1] It is the noncontact IC card characterized by this adhesives layer making a flat side to the field by the side of said sheathing sheet while carrying out the laminating of the sheathing sheet to vertical both sides of the pin center, large core of the shape of a sheet which connotes IC chip through the adhesives layer in the noncontact IC card which connotes IC chip in the layered product of a plastic sheet.

[Claim 2] The noncontact IC card according to claim 1 characterized by connoting without filling up this cavernous section with adhesives at the cavernous section formed in said pin center, large core in said IC chip.

[Claim 3] In the noncontact IC card which connotes IC chip in the layered product of a plastic sheet By carrying out thermal melting arrival of the 1st internal sheet which consists of plastics in which the through hole corresponding to the configuration and dimension of said IC chip was formed to vertical both sides of the circuit board in which IC chip was prepared By connoting said IC chip to the through hole of said 1st internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said 1st internal sheet from plastics It is the noncontact IC card which closes the upper part and the lower part of said through hole, comes to carry out the laminating of the sheathing sheet which becomes each of said 2nd internal sheet from plastics further through an adhesives layer, and is characterized by this adhesives layer making a flat side to the field by the side of said sheathing sheet.

[Claim 4] The noncontact IC card according to claim 3 characterized by connoting without filling up the through hole of said 1st internal sheet with said IC chip, and filling up this through hole with adhesives.

[Claim 5] Are the approach of manufacturing a noncontact IC card according to claim 3, and the 1st internal sheet is produced by forming in a plastic sheet the through hole corresponding to the configuration and dimension of IC chip prepared in the circuit board. By carrying out thermal melting arrival of the 1st internal sheet to vertical both sides of said circuit board By connoting said IC chip in the through hole of said 1st internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said 1st internal sheet from plastics The manufacture approach of the noncontact IC card characterized by pasting up the sheathing sheet which becomes finishing and this adhesives layer from plastics about the front face of this adhesives layer in a flat side while applying adhesives to vertical both sides of said 2nd internal sheet, after closing the

upper part and the lower part of said through hole.

[Claim 6] The manufacture approach of the noncontact IC card according to claim 5 characterized by connoting without filling up the through hole of said 1st internal sheet with said IC chip, and filling up this through hole with adhesives.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a noncontact IC card and its manufacture approach.

[0002]

[Description of the Prior Art] In order that a noncontact IC card (it may be hereafter written as an IC card or a card) may receive power and a signal by wireless, the inner package of the circuit board in which IC chip, the antenna, the capacitor, etc. were mounted is carried out into the card. In manufacture of this noncontact IC card, the sheathing sheet which becomes above-mentioned circuit board from plastics, for example, PET, (polyethylene terephthalate resin), and the sheet which consists of PVC (polyvinyl chloride resin) laminate (laminating).

[0003] Drawing 5 is the important section sectional view showing an example of the conventional noncontact IC card. In this noncontact IC card 20, the adhesion laminating of the sheathing sheet 23 is carried out to both sides of the circuit board (circuit board film) 21 in which IC chip 21a was carried with the adhesives which use an epoxy resin as a principal component. It is the gestalt embedded in the adhesives layer 22 with which adhesives were applied to vertical both sides of the circuit board 21, the adhesives layer 22 was specifically formed, and the laminating of the sheathing sheets 23 and 23 was carried out to these adhesives layers 22 and 22, therefore the circuit boards 21 (and IC chip 21a etc.) were filled up in the opposite space of the up-and-down sheathing sheets 23 and 23. Thus, the conventional noncontact IC card 20 is the thing of five layer systems which consist of the sheathing sheet of two sheets, an up-and-down adhesives layer, and the circuit boards (and IC chip etc.).

[0004] In being able to write in an alphabetic character, a picture, etc. repeatedly by a printer etc. now, the sheathing sheet which has the rewrite function which can eliminate these is developed, and this sheathing sheet is already put in practical use by some of member cards and point cards, and is making a big achievement. in order to apply the above-mentioned function to a noncontact IC card, a card face must be enough made into flatness (: with high flatness -- smoothness is high). For that purpose, the lamination method of construction and card laminated structure in the case of producing an IC card need to be developed.

[0005]

[Problem(s) to be Solved by the Invention] However, it was difficult to lose the irregularity of the front face and to finish evenly in the noncontact IC card 20 of the structure shown in drawing 5 . When (1) adhesives layer 22 hardens, thinking as the cause Stress occurs inside a card, distortion arises between the circuit board 21 and the

sheathing sheet 23, it originates in this distortion, and irregularity occurs on the sheathing sheet 23, And it is that the display flatness of the (2) circuit board 21 is low, and the difference of elevation with the circuit board 21, IC chip 21a, a capacitor, an antenna (all are figure abbreviation), etc. is dramatically large, and the concavo-convex pattern of the circuit board 21 will appear in the front face of the sheathing sheet 23.

[0006] In order to perform ornament processing of printing etc. to a card face, i.e., the sheathing sheet front face, in many cases, the surface smoothness of a card face is dramatically important. However, with the above-mentioned conventional card, since irregularity had occurred not a little on the front face, when commodity value not only falls, but the appearance was spoiled and printing, a pattern, etc. were written in the card face by the printer etc., there was a problem in which an alphabetic character is missing or the color or profile of a pattern do not appear clearly.

[0007] This invention tends to offer cheaply the noncontact IC card of the high quality the process which laminates a sheathing sheet (laminating) excelled [ high quality ] in development and the circuit board of a card laminated structure at surface smoothness based on influencing greatly the appearance and printing engine performance of a noncontact IC card.

[0008] That is, the 1st object of this invention is excellent in the surface smoothness of a card face, and is to offer cheaply the noncontact IC card which can perform exact and clear printing to a card face, and pattern printing with an easy configuration. The 2nd object of this invention is offering the manufacture approach which is an easy process and can mass-produce the above-mentioned noncontact IC card with the sufficient yield.

[0009]

[Means for Solving the Problem] While the noncontact IC card concerning this invention (the 1st invention) carries out the laminating of the sheathing sheet to sheet-like the top face and underside of a pin center, large core which connote IC chip through an adhesives layer in the noncontact IC card which connotes IC chip in the layered product of a plastic sheet, this adhesives layer is characterized by making a flat side to the field by the side of said sheathing sheet.

[0010] In this IC card, since both sides of this IC card were evenly finished by absorbing the irregularity of vertical both sides of a pin center, large core in an adhesives layer, it excels in an appearance and an alphabetic character and a pattern can be vividly printed by a printer etc. to a card face.

[0011] It is desirable to consider as the structure connoted without filling up adhesives with the IC card of this invention into this cavernous section at the cavernous section formed in the pin center, large core in IC chip. According to this structure, in the adhesives restoration process to the above-mentioned cavernous section becoming unnecessary, compared with the case where it is filled up with adhesives, irregularity of a pin center, large core front face can be made small.

[0012] Moreover, the noncontact IC card concerning this invention (the 2nd invention) In the noncontact IC card which connotes IC chip in the layered product of a plastic sheet By carrying out thermal melting arrival of the 1st internal sheet which consists of plastics in which the through hole corresponding to the configuration and dimension of said IC chip was formed on the top face and underside of the circuit board in which IC chip was prepared By connoting said IC chip to the through hole of said 1st internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said

1st internal sheet from plastics It is characterized by having closed the upper part and the lower part of said through hole, having come to carry out the laminating of the sheathing sheet which becomes each of said 2nd internal sheet from plastics further through the adhesives layer, and this adhesives layer making a flat side to the field by the side of said sheathing sheet.

[0013] In this IC card, by absorbing the irregularity of pin center, large core vertical both sides in the above-mentioned adhesives layer, since both sides of this IC card are finished evenly, it excels in an appearance, and an alphabetic character and a pattern can be vividly printed by a printer etc. to a card face. Moreover, this IC card can be continuously manufactured at an easy process, and although moreover considered as the structure which carried out the laminating of the nine layers including the adhesives layer, it can be pressed down in thickness equivalent to the conventional IC card.

[0014] It is desirable to consider as the structure connoted without filling up the through hole of said 1st internal sheet with IC chip, and filling up adhesives with the above-mentioned IC card into this through hole. By carrying out like this, the adhesives restoration process to the above-mentioned through hole becomes unnecessary. Moreover, with the above-mentioned pin center, large core (five-layer layered product), although the 2nd internal sheet is somewhat dented in the above-mentioned through hole side, the amount is few, and since the irregularity resulting from having laid IC chip underground in the adhesives packed bed does not occur unlike the conventional IC card (this is also a five-layer layered product) shown in drawing 5, the irregularity of the above-mentioned pin center, large core front face falls substantially compared with the IC card of drawing 5.

[0015] Furthermore, the manufacture approach of the noncontact IC card concerning this invention (the 3rd invention) Are the approach of manufacturing the IC card of the 2nd invention of the above, and the 1st internal sheet is produced by forming in a plastic sheet the through hole corresponding to the configuration and dimension of IC chip prepared in the circuit board. By carrying out thermal melting arrival of the 1st internal sheet to the top face and underside of said circuit board By connoting said IC chip in the through hole of said internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said 1st internal sheet from plastics After closing the upper part and the lower part of said through hole, while applying adhesives to said the 2nd top face and underside of an internal sheet, it is characterized by pasting up the sheathing sheet which becomes finishing and this adhesives layer from plastics about the front face of this adhesives layer in a flat side.

[0016] It is desirable to connote without filling up the through hole of said 1st internal sheet with IC chip, and filling up adhesives with this manufacture approach into this through hole. By carrying out like this, in a production process's becoming still easier, since the above-mentioned adhesives become unnecessary, an IC card can be offered more cheaply.

[0017]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing. Drawing 1 is the sectional view showing the important section structure of a noncontact IC card. This card 10 has a nine-layer laminated structure which consists of a pin center, large core 6 of a five-layer laminated structure, and the adhesives layer 2 and the sheathing sheet 1 which carried out the laminating to

each of the top face of this, and an underside.

[0018] The pin center, large core 6 more specifically on the top face and underside of the circuit board 3 in which IC chip (IC module) 3a was prepared By carrying out thermal melting arrival of the 1st internal sheet 5 which consists of plastics in which through hole 5a corresponding to the configuration and dimension of IC chip 3a was formed It has structure which closed the upper part and the lower part of through hole 5a by connoting IC chip 3a to the above-mentioned through hole 5a (receipt), and carrying out thermal melting arrival of the 2nd internal sheet 4 which turns into the 1st internal sheet 5 from plastics.

[0019] And IC card 10 is constituted by carrying out the laminating of the sheathing sheet 1 which consists of plastics to the 2nd internal sheet 4 which forms the surface layer of the pin center, large core 6 through the adhesives layer 2, and, as for the adhesives layer 2, the flat side is made to the field by the side of the sheathing sheet 1.

[0020] Below, the manufacture approach of this IC card 10 is explained. First, the internal sheets 4 and 5 which consist of the sheathing sheet 1 which consists of rewrite PET, adhesives, a tape career (tape carrier package), and PET-G (trade name concerning the PET system copolymer by Dai Nippon Printing Co., Ltd.) as an ingredient for manufacturing this card are prepared.

[0021] What can be written in by the printer of dedication of an alphabetic character, a pattern, etc. as the above-mentioned sheathing sheet 1 is used. the circuit board 3 in which the above-mentioned tape career mounted IC chip 3a etc. -- a plastic sheet top -- and a large number are intermittently prepared in the longitudinal direction. The internal sheet 5 is equivalent to the internal sheet of the above 1st, and the internal sheet 4 corresponds to the internal sheet of the above 2nd.

[0022] using the above-mentioned tape career -- future -- many -- it is for manufacturing the IC card of several sheets, and one IC chip is equivalent to the IC card of one sheet in this tape career. Through hole 5a corresponding to the configuration and dimension of IC chip 3a in the IC card of one sheet is intermittently formed in the 1st internal sheet 5 at the longitudinal direction of a sheet. Moreover, as the sheathing sheet 1, the 1st, the 2nd internal sheet 5 and 4, and a tape career, the thing (delivery roll) of the shape of a roll which rolled round the long sheet is prepared for a winding core (figure abbreviation).

[0023] As the above-mentioned adhesives, the epoxy system adhesives (a 1 liquid type or 2 liquid type) hardened, for example in ordinary temperature or infrared hardening mold adhesives (what added the sensitizer to epoxy 1 liquid type system adhesives or thoria chestnut RATO oligomer) is used. Moreover, a hyperviscous thing is desirable the thing of the fast curability hardened in several seconds among epoxy system adhesives, especially quick-drying. In using infrared hardening mold adhesives, let the sheathing sheet 1 be a transparence sheet. Since each above-mentioned adhesives can be stiffened without heating, they do not have a fear of IC chip 3a etc. being damaged with heating.

[0024] On the occasion of manufacture of an IC card, the pin center, large core 6 shown in drawing 1 at a preceding paragraph process is produced, and the sheathing sheet 1 is pasted up on vertical both sides of this pin center, large core 6 at a latter-part process. In this case, a roll two roll performs the whole production process. That is, let continuously all of the above-mentioned tape career, sheathing sheet 1 and 1st, and 2nd internal sheet 5 and 4 out, it is made to all run from a delivery roller, a laminating is performed continuously, and it considers as the following nine-layer layered product, and after

rolling this round and rolling round on a roller, this nine-layer layered product is pierced in the configuration and dimension of a predetermined IC card, and it considers as an IC card.

[0025] If the process of the preceding paragraph is explained, by thermal melting arrival, the laminating of the 1st internal sheet 5 will be carried out to vertical both sides of the above-mentioned tape career, and a three-layer layered product will be obtained to them. For example, RF junction or ultrasonic jointing performs this laminating. Moreover, at this process, it is important for through hole 5a of the 1st internal sheet 5 to position IC chip 3a, and IC chip 3a is contained by this at through hole 5a. Subsequently, the laminating of the 2nd internal sheet 4 is carried out to vertical both sides of the above-mentioned three-layer layered product by thermal melting arrival, and the five-layer layered product 6, i.e., a pin center, large core, is obtained. The adhesives for adhesives layer 2 formation are applied to vertical both sides of this pin center, large core 6, the sheathing sheet 1 is made into a nine-layer layered product by stiffening superposition and adhesives in this spreading side, this is rolled round, and it rolls round on a roller (figure abbreviation). Punching of this nine-layer layered product is carried out as mentioned above, and it considers as an IC card.

[0026] At the above-mentioned laminating process, the so-called doctor blade coating, MAIYA bar coating, reverse roll coating, DIP coating, etc. can perform the adhesives spreading process to vertical both sides of the pin center, large core 6. Moreover, when DIP coating is applied, adhesives can also be simultaneously applied to vertical both sides of a pin center, large core by request.

[0027] Especially this adhesives spreading process is important for this invention. The part which counters the above-mentioned IC chip stowage among the 2nd internal sheet 4 with the pin center, large core 6 since the stowage of IC chip 3a is cavernous section 5a by namely, that which is somewhat dented in the above-mentioned cavernous section 5a side (it caves in) In the above-mentioned adhesives spreading process, the irregularity of pin center, large core 6 front face can be absorbed by finishing the front face of an adhesives layer evenly with a doctor blade or a squeegee roll in the above-mentioned adhesives layer 2, and the surface smoothness of IC card 10 both sides acquired eventually can be secured.

[0028] IC card 10 of drawing 1 serves as structure contained without filling up with IC chip 3a cavernous section 5a formed in the pin center, large core 6, and filling up this cavernous section 5a with adhesives -- \*\*\*\* (a stowage is a cavity) -- the above-mentioned stowage can be filled up with adhesives by request, and it can also consider as the gestalt which embedded IC chip 3a in the adhesives layer.

[0029] As structure of the IC card concerning this invention, the sheet of the structure by which (1) cross section other than the above is shown in drawing 5 is used as a pin center, large core. What used as the pin center, large core the sheet of the structure by which what carried out the laminating of the sheathing sheet to vertical both sides of this through the adhesives layer, and (2) cross sections are shown in drawing 5, and carried out the laminating of an internal sheet, an adhesives layer, and the sheathing sheet to this order to vertical both sides of this is mentioned.

[0030] Drawing 2 is the bird's-eye view where cross-section structure measured the surface display flatness of the IC card shown in drawing 1 with the laser interferometer, and was acquired, and, similarly drawing 3 is a contour map. Drawing 4 is the

photograph which printed by the printer on the front face of this IC card, and photoed this printing side with the close-up photography camera. printing section 10a of this card -- the direction of a short hand of a card -- meeting -- the bottom from drawing 4 -- the alphabetic character of "woods", "\*\*\*\*", "\*\*\*\*", "\*\*\*\*", "\*\*\*\*", the "head", "\*\*\*\*", a "tail", "\*\*\*\*", an "opportunity", "woods", "woods", and "woods" -- this order -- and right-hand side of drawing 4 be made into an alphabetic character upside, and a large number train printing be carried out

[0031] On the other hand, drawing 6 is the bird's-eye view where cross-section structure measured the surface display flatness of the conventional IC card shown in drawing 5 with the same laser interferometer, and was acquired, and, similarly drawing 7 is a contour map. Moreover, drawing 8 is the photograph which printed by the printer on the front face of this IC card, and photoed this printing side with the close-up photography camera. Along the direction of a short hand of a card, from on drawing 8, down, only the alphabetic character of "\*\*\*\*" makes right-hand side of drawing 8 an alphabetic character upside, and turns a large number printing at printing section 20a of this card.

[0032] It excels in the IC card of this invention at surface surface smoothness to comparing drawing 2, 3 and drawing 6, and 7, and surface irregularity being [ like / it is \*\*\*\*\* and ] conspicuous with the conventional IC card. moreover -- that the part (printing poor section 20b) which printing lacked in the conventional IC card occurs so that it may understand by the comparison of drawing 4 and drawing 8 \*\*\*\*\* -- printing -- with the IC card of this invention, the clear printing result was obtained over the whole printing section to the indistinct part having occurred in the shape of a muscle.

[0033]

[Effect of the Invention] While the noncontact IC card concerning claim 1 carries out the laminating of the sheathing sheet to sheet-like the top face and underside of a pin center, large core which connote IC chip through an adhesives layer, this adhesives layer By considering as the structure which made the flat side to the field by the side of said sheathing sheet, and absorbing the irregularity of pin center, large core vertical both sides in an adhesives layer Since the flat side was made to both sides of this IC card, it excels in an appearance, and an alphabetic character and a pattern can be vividly printed by a printer etc. to a card face.

[0034] In the noncontact IC card concerning claim 2, irregularity of a pin center, large core front face can be made small in the card of claim 1 compared with the case where the cavernous section formed in the pin center, large core in IC chip is filled up with adhesives in the adhesives restoration process to the above-mentioned cavernous section becoming unnecessary, since it connoted without filling up this cavernous section with adhesives.

[0035] The noncontact IC card concerning claim 3 by carrying out thermal melting arrival of the 1st internal sheet which consists of plastics in which the through hole corresponding to the configuration and dimension of said IC chip was formed on the top face and underside of the circuit board in which IC chip was prepared By connoting said IC chip to the through hole of said 1st internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said 1st internal sheet from plastics The upper part and the lower part of said through hole are closed, the laminating of the sheathing sheet which becomes each of said 2nd internal sheet from plastics further is carried out through an adhesives layer, and this adhesives layer is made into the



structure which made the flat side to the field by the side of said sheathing sheet.

[0036] In this IC card, by absorbing the irregularity of pin center, large core vertical both sides in the above-mentioned adhesives layer, since both sides of this IC card are finished evenly, it excels in an appearance, and an alphabetic character and a pattern can be vividly printed by a printer etc. to a card face. Moreover, this IC card can be continuously manufactured at an easy process, and although it moreover has structure which carried out the laminating of the nine layers including the adhesives layer, it can be pressed down in thickness equivalent to the conventional IC card.

[0037] In the noncontact IC card concerning claim 4, in the card of claim 3, since it connoted without filling up the through hole of said 1st internal sheet with IC chip, and filling up this through hole with adhesives, the adhesives restoration process to the above-mentioned through hole becomes unnecessary. Moreover, with the above-mentioned pin center, large core (five-layer layered product), although the 2nd internal sheet is somewhat dented in the above-mentioned through hole side, the amount is few, and since the irregularity resulting from having laid IC chip underground in the adhesives packed bed does not occur unlike the conventional IC card (this is also a five-layer layered product) shown in drawing 5, the irregularity of the above-mentioned pin center, large core front face falls substantially compared with the IC card of drawing 5.

[0038] By the manufacture approach of the noncontact IC card concerning claim 5 Face manufacturing the card concerning claim 3 and the 1st internal sheet is produced by forming in a plastic sheet the through hole corresponding to the configuration and dimension of IC chip prepared in the circuit board. By carrying out thermal melting arrival of the 1st internal sheet to the top face and underside of said circuit board By connoting said IC chip in the through hole of said 1st internal sheet, and carrying out thermal melting arrival of the 2nd internal sheet which becomes each of said 1st internal sheet from plastics After closing the upper part and the lower part of said through hole, while applying adhesives to said the 2nd top face and underside of an internal sheet, the sheathing sheet which becomes finishing and this adhesives layer from plastics about the front face of this adhesives layer in a flat side is pasted up.

[0039] For this reason, according to this manufacture approach, the noncontact IC card of high quality can be continuously mass-produced with the sufficient yield by the simple process, especially the roll two roll method.

[0040] By the manufacture approach of the noncontact IC card concerning claim 6, in the manufacture approach of claim 5, since a production process can twist still more easily since it was made to connote, without filling up the through hole of said 1st internal sheet with IC chip, and filling up this through hole with adhesives, and the above-mentioned adhesives become unnecessary, an IC card can be offered more cheaply.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the important section structure of the noncontact IC card concerning this invention.

[Drawing 2] It is the bird's-eye view showing the display flatness on the front face of an

IC card of drawing 1 .

[Drawing 3] It is a high diagram that the display flatness on the front face of an IC card of drawing 1 is shown etc.

[Drawing 4] It is the top view showing the printing condition on the front face of an IC card of drawing 1 .

[Drawing 5] It is the sectional view showing the important section structure of the conventional noncontact IC card.

[Drawing 6] It is the bird's-eye view showing the display flatness on the front face of an IC card of drawing 5 .

[Drawing 7] It is a high diagram that the display flatness on the front face of an IC card of drawing 5 is shown etc.

[Drawing 8] It is the top view showing the printing condition on the front face of an IC card of drawing 5 .

[Description of Notations]

1 [ -- The 2nd internal sheet, 5 / -- The 1st internal sheet, 5a / -- A through hole (cavernous section), 6 / -- A pin center, large core, 10 / -- A noncontact IC card, 10a / -- The printing section, 20 / -- A noncontact IC card, 20a / -- The printing section, 20b / -- The poor printing section, 21 / -- The circuit board, 21 a--IC chip, 22 / -- An adhesives layer, 23 -- Sheathing sheet. ] -- A sheathing sheet, 2 -- An adhesives layer, 3 -- The circuit board, 3 a--IC chip, 4

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